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DIFFICULTIES IN THE USE OF EQUIVALENCE SCALES FOR NORMATIVE PURPSOSES

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Abstract

Can we make welfare comparisons of households of different characteristics on the basis of their observed behavior in relation to commodity demands? This paper reviews some of the fundamental difficulties encountered in the attempt to use the concept of an equivalence scale as a vehicle for introducing demographics and other characteristics into empirical demand analysis and, at the same time, for establishing interpersonal comparisons of well-being.

Key Words
Equivalence Scales; Interpersonal Comparisons of Utility.

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Introduction

From the begining of the analysis of cross-section budget data, some practicioners have always been tempted by the possibility of establishing welfare comparisons of households of different characteristics on the basis of their observed behavior.

Concentrating on demographic characteristics, households of different size and composition are said to have different "needs", which were supposed to be summarized by a set of numbers, one for each type of household, with the unit value usually given to a single male or a couple without children. Such an adult "equivalence scale", with which the budgets of different households could be converted to a needs-corrected basis, was supposed to be inferred, along other parameters of the demand system, from the observed consumption patterns of households of different demographic profiles.

One could hardly exaggerate the practical and political importance of such comparisons for matters of public policy. Also, in large parts of applied welfare economics we presuppose that individual utility levels have been adjusted for whatever differences in needs are relevant from an ethical point of view. Finally, as Blackorby [1990] asserts, in so far as modern second-best theory indicates that policy recommendations cannot be distribution free "... our choice is between making interpersonal comparisons of utility or in having little or nothing to say".

Given this pressure, it is rather conforting that early attempts to find an economic behavioral basis for welfare comparisons have been placed into an appropiate conceptual framework by means of contemporary duality theory and the theory of the cost-of-living index.[1] However, this does not mean that all is well and settled in the foundations of this area. In particular, most economists would agree that the leap from behavior to welfare ought to be taken -if at all- with the greatest care. Thus, this Conference provides us with an opportunity to review the long list of objections that have been raised against the use of equivalence scales for normative purposes.

The rest of this paper is organized in three sections. The first is devoted to the specification of the individual decision problem, and the distinction between conditional and unconditional preferences. The second section discusses some of the fundamental difficulties encountered in the attempt to use the concept of an equivalence scale as a vehicle for introducing demographics and other characteristics into empirical demand analysis and, at the same time, for establishing interpersonal comparisons of well-being. The last section includes some concluding comments.

[1] For a survey of the early work, which has its origins in Engel [1895], see Prais and Houthakker [1955], and Brown and Deaton [1972]. Building on the seminal work by Barten [1964], the modern treatment starts with Muellbauer [1974] and Gorman [1976]. For an excelent discussion, which includes most of the points raised here, see Deaton and Muellbauer [1980], and the brief review by Deaton [1986].

1 Notation, definitions and assumptions

Like the majority of the empirical papers in this area, let us concentrate for the moment on how households allocate current total expenditures among a number of consumption goods and services.

Households are allowed to differ because two types of observable characteristics: those subject to choice, like the geographic location, the stock of durables, the household size, or the number and spacing of children; and those independent of households decisions, like each person's race or sex, or the age of adult household members. Thus, each household h in a typical sample of size H is identified by two vectors: a vector a^h in a set $\mathcal{A}$ of characteristics of the first type, and a vector b^h in a set $\mathcal{B}$ of characteristics of the second type. For each household, we also observe an n-dimensional vector of commodities, q^h, and a real number x^h representing current total expenditure, such that $x^h = p \cdot q^h$, where p is an n-dimensional vector of prices.

As far as household behavior is concerned, it is assumed that, subject to the corresponding budget constraint, each household maximizes a utility function U^h, which represents what is known in the literature as its *conditional* preferences for commodities; that is, its preferences given its observable characteristics of all sorts.

In a classic paper, Pollak and Wales [1979] argued that such conditional preferences are not appropiate for welfare comparisons because they do not take into account the direct effect of household characteristics on utility. Thus, for instance, to compare the welfare of households with a different number of adults, economies of scale in consumption would have to be contrasted with a desire for privacy which may very well be a decreasing function of household size. Similarly, in a country like Spain, both the weather and nationalistic feelings are likely to influence the utility enjoyed from living in different autonomic regions.

To formalize this position, it will be useful to assume that each household has solved an optimal problem, which need not be specified here, for the choice of a vector $\hat{a}^h$ in $\mathcal{A}$. Then, each household with characteristics $(b^h, \hat{a}^h)$ will be endowed with a set of *unconditional* preferences for commodities *and* characteristics subject to choice. These preferences will be assumed to be representable by a utility function

$$u = V^h(q, a),$$

which gives the unconditional utility that a household of characteristics b^h which has chosen the vector $\hat{a}^h$ would have when confronted with any pair consisting of a vector q in R^n_+ and a vector a in $\mathcal{A}$.

In this context, and regardless of whether $a^h = \hat{a}^h$ or not, it is natural to assume that conditional preferences for commodities result from the restriction of the unconditional utility function to the commodity space, given the observed vector of characteristics subject to choice, that is,

$$U^h(q) = V^h(q, a^h) \qquad \forall h = 1, \ldots, H.$$

Thus, in general, conditional choices of commodities depend on the usual economic variables, prices and total expenditures, as well as on the following vectors of characteristics: b^h, $\hat{a}^h$ and a^h.

On the other hand, if we now denote by $C^h(u, p, a)$ the unconditional cost function of the h-th household, we can extend the theory of the cost-of-living index for an individual to cover the comparisons of different demographic (or other) profiles within the set $\mathcal{A}$: an *equivalence scale* $D^h(u, p, a)$ for a household h is defined by

$$D^h(u, p, a) = \frac{C^h(u, p, a)}{C^h(u, p, a^o)},$$

which gives the cost of attaining a utility level u at prices p by a household of characteristics a, relative to the cost of attaining that utility level at those prices by a reference household of characteristics a^o.

It should be pointed out that, in the language of the theory, in this framework the term "household needs" is equivalent to "household unconditional preferences". Therefore, for each h in the population the equivalence scale $D^h(u, p, a)$ provides the numbers with which one would deflate the distribution of total expenditures in order to adjust it to a needs-corrected basis, according to *this* household's unconditional preferences.

2 Some difficulties in the use of equivalence scales for welfare economics

2.1 How many equivalence scales?

As Pollak and Wales [1979] insist, as long as there are different unconditional preferences, true interpersonal comparisons of satisfaction of the type "strong desire for children, three children, \$13.000 vs. weak desire for children, two children, \$12.000", require a mapping specifying, for every utility level, which indifference set from each unconditional indifference map provides that given level of well-being.

In the terminology of the latest contribution by Pollak [1990] to this debate, these are "welfare comparisons" about which he manifests himself "unwilling to dismiss them as a priori impossible or clearly meaningless". However, he reminds us very forcefully that "Finding mathematical correspondences between two indifference maps is easy; establishing that a particular correspondence is a welfare correspondence is hard". As a matter of fact, we must conclude with him that "without a theory, any correspondence selected is arbitrary". And such a theory of interpersonal comparisons is still lacking.

In view of this, and in order to continue the search for some behavioral foundation of a meaningful equivalence scale, we shall assume that, independently of the optimal choices $\hat{a}^h$, all households share a unique unconditional utility function; that is,

$$u = V^h(q,a) = V(q,a), \qquad \forall h = 1,\ldots,H.^2$$

Consequently, we will have a single equivalence scale

$$D(u,p,a) = \frac{C(u,p,a)}{C(u,p,a^o)},$$

where $C(u,p,a)$ is the unconditional cost function common to all households. These numbers entail what Pollak [1990] would call "situational comparisons", always legitimate as long as we make them in terms of a single unconditional preference ordering.

2.2 Does equal utility imply equal welfare?

Even if this model were to be empirically correct, Fisher [1987, 1990] claims that being on the same indifference curve is not a sufficient reason to assert that two households enjoy the same welfare. This is a normative decision which, in his opinion, we might not want to adopt because of either of the following reasons:

[2]Notice that, in this formulation, either the characteristics not subject to choice do not matter at all, or its influence can be easily incorporated within a single parametric representation, say:

$$u = V_b(q,a), \qquad \forall b \in \mathcal{B}.$$

1. Even if two households have identical preferences, we may want to move beyond utility considerations towards richer information environments, where relative moral worths (Fisher and Rothenberg [1961]) or relative "capabilities" or freedom to live decent lives (Sen [1984a, 1985]) are also taken into account.

2. Fisher provides an example in which larger families enjoy the same utility level than smaller ones in a situation in which, due to the substitution effects induced by children in Barten's model of commodity specific equivalence scales, these families face different prices for milk in terms of whisky. Then, rather than accepting the value judgement according to which we ought to treat symmetrically the ability of larger families to buy milk and of smaller ones to afford whisky, Fisher suggests that we might find ethically indispensable to examine also the consumption vectors of both types of households.

3. Finally, tastes differences associated to certain attributes might not be ethically neutral, however well are captured in a given empirical model. As Fisher points out, systematic differences between the preferences of blacks and whites may partly reflect past income or past social status. Think also of the possiblity of sex discrimination in the treatment of male and female children within the household, as documented in Sen [1984b]. What should we conclude from a normative point of view if, as a result, it costs more to maintain a certain utility level in households with expensive tastes or a prevalence of children of a given gender?

Perhaps we don't know yet how to treat differences in capabilities and other fundamental rights, and we still lack clear criteria on the ethical desirability of different commodity bundles. But if morally objectionable private tastes happen to explain people's choices, surely it would be unwise to use them uncritically in situational comparisons.

2.3 How likely is the empirical model?

For those who want to pursue the study of the empirical literature in spite of Fisher's objections, it is worth while to recall that the road from the evidence on conditional choices to the estimation of some common unconditional preferences starts from the assumption that, for each h, q^h solves the problem of maximizing $V(q, a^h)$ subject to the corresponding budget constraint.

For this process to have any hope of success, we must impose further restrictions on conditional preferences. To begin with, for the application of the theory of the cost-of-living index it is necessary that, at any utility level, the indifference curves of any pair of different households do not intersect -a requirement that is never made explicit.

As far as the empirical implementation of the model, one starts by selecting a complete, theoretically plausible demand system, say $q = q(p, x)$. Then, the most general assumption is that households of different characteristics will have different demand systems because the conditional utility functions $V(q, a^h) = U^h(q)$ are all distinct -a fact that can only be tested with panel data, and that will be of little help in the recovery of unconditional preferences. At the opposite extreme, one may test the hypothesis that

household characteristics do not matter at all, i.e., that $V(q, a^h) = U(q)$ for all h, in which case the preferences' recovery will be also impossible.

Somewhere in between, is the possibility that household characteristics influence all the parameters of the demand system, but in a different manner for each of the subsets of a partition of the sample; that is, given a partition in terms of one or more observable characteristics into T_r different types, $r = 1, \ldots, R$,

$$V(q, a^h) = U^r(q) \qquad \forall h \in T_r$$

Unfortunately, this situation is undistinguishable from the existence of types at the unconditional level, i.e.,

$$V^h(q, a) = V^r(q, a) \quad \text{and} \quad V^r(q, a^h) = U^r(q) \qquad \forall h \in T_r,$$

in which case we would be back in the untractable "welfare comparisons" problem. Thus, the only possibility compatible with our purpose is that the differences in conditional tastes could be conveniently parametrized within the confines of a single utility function for the whole sample, indexed by the vector of observable characteristics.

To summarize, the following are the a priori conditions under which it makes sense the attempt to base the situation comparisons embodied in a single equivalence scale on the observed commodity choices of a sample of households with different characteristics:

(1) $V^h(q, a) = V(q, a) \qquad \forall h = 1, \ldots, H;$
(2) $\forall u, \forall a^h, a^{h'} \in \mathcal{A}, \{q \in R^n_+ : V(q, a^h) = u\} \cap \{q \in R^n_+ : V(q, a^{h'}) = u\} = \emptyset;$
(3) $V(q, a^h) = U_{a^h}(q) \qquad \forall h = 1, \ldots, H.$

A natural question to ask is how likely are these conditions in practice? Three types of remarks are in order.

1. In the first place, as Pollak and Wales [1979] point out, it is difficult to believe that the distribution of unconditional preferences is independent of the distribution of household characteristics, particularly those which are subject to choice. Think, for example, of the direct preferences for children of chlildless bachelors or couples of a variety of sexual persuasions, relative to households which conciously decided to have them in large numbers.

2. So far we have restricted ourselves to the allocation of current expenditures, but it should be clear that the framework can be adapted to deal with intertemporal considerations or the interactions of demographics, time use and work effort.[3]

For example, in Pashardes [1989], parents may provide for the cost of raising children partly by reducing their current expenditures and partly by drawing on their savings, including the depletion of the stocks of durables, or their capacity to borrow. This leads to equivalent income -rather than expenditures- scales, which may be influenced by the

[3]See the discussion of these extensions in Deaton and Muellbauer [1980]. Browning [1990] reviews the impact of children on a variety of economic decisions.

differences in the availability of credit across household types. On the other hand, it suffices to mention the work of Browning and Meghir [1991] for the likely size of the bias on the estimated effect of children from ignoring labor supply considerations.

It can be argued that some government programs may be intended to maintain a minimum short-run, narrowly defined, concept of welfare for all households. Nevertheless, for other purposes in welfare economics, the broader the commodity space and the behavior that is modeled to produce estimates of equivalence scales, the more appropiate from a normative point of view.

3. Within the ordinalist tradition, there is a long resistance to accept that individuals can be reduced to a list of characteristics. On the other hand, there is some moral worth in the position that the only individual features one ought to take into account in our concept of economic welfare are those observable, objective characteristics which may influence people's behavior. Be it as it may, there is little doubt about the desirability of enlarging as much as possible the vector of household characteristics.

In relation to points 2 and 3, it might be the case that the broader the behavior considered and/or the richer the characteristics' space, the most likely that household heterogeneity will carry the day versus the hypothesis that differences in tastes can be allowed for by the indexing of a single utility function. The use of large sets of microdata, which will liberate empirical work from the restrictions imposed by exact agreggation considerations and parametric methods, might also point in this direction[4].

2.4 Can we ever recover unconditional preferences?

Even if the above necessary conditions were empirically satisfied, Pollak and Wales [1979] were again the first to call the attention to a difficulty of a more fundamental nature. The problem is simply that, given $V(q,a)$, for any function F monotonic in its first argument,

$$F[V(q,a),a] = W(q,a)$$

represents different unconditional preferences for commodities and characteristics, leading to a different cost function and equivalence scale, but gives rise to the same system of Marshalian demand functions. Consequently, as they put it: "Observed differences in the consumption patterns of two- and three-child families cannot even tell us whether the third child is a blessing or a curse."

More precisely, Blundell and Lewbel [1990] have shown that given any observed demand system, one can find a unique cost function that rationalizes the conditional choices and yields any possible values for equivalence scales in any one given price regime p^o. However, the uniqueness of such cost function implies that, if the true values of the equivalence

[4]Browning [1990] reports significant variation in the correlation between women's labor supply and children across race, age, marital status and education. Gozalo [1990], in one of the first applications of non-parametric techniques to the estimation of a system of Engel curves, finds evidence of heterogeneity by household types, a fact also established with the benefit of microdata in Barnes and Gillingham [1984]. See also the results of Pollak and Wales [1980, 1981], Muellbauer [1977], and Nelson [1988].

scale in one price regime is known, then observable demands can be used to recover the values of the true equivalence scale in all other price regimes.

To illustrate the force of this result, consider the following decomposition for any equivalence scale:

$$D(u,p,a) = \frac{C(u,p,a)}{C(u,p,a^o)} = \frac{C(u,p,a)/C(u,p^o,a)}{C(u,p,a^o)/C(u,p^o,a^o)} \frac{C(u,p^o,a)}{C(u,p^o,a^o)}$$
$$= \frac{L(p,p^o,u,a)}{L(p,p^o,u,a^o)} \frac{C(u,p^o,a)}{C(u,p^o,a^o)},$$

where $L(p,p^o,u,.)$ is a cost-of-living index comparing prices p and po at the utility level u for the corresponding household. The result says that only the ratio of household specific cost-of-living indices -that is, the *relative* equivalence scale- can be identified with demand data alone; however, nothing can be said in the base price regime p^o.

Then, what is to be done in the usual case with time series data on conditional choices, prices, and household characteristics? According to Blundell and Lewbel there are three alternatives:

i) Collect additional data to overcome the identification problem. Data on revealed preference for household characteristics subject to choice, on subjective opinions in the manner of Van Praag and his associates[5], or on poverty lines for households of different profiles.

ii) Report solely those results which are independent of the choice of F, i.e., the ratio of household specific cost-of-living indices, which inform us solely on the way equivalence scales change over time in response to price changes.

iii) Given any U consistent with the demand system, identify an equivalence scale by the cardinalization of utility which results from the selection of an arbitrary choice of F by means of untestable, but hopefully reasonable and explicit, assumptions. This last route is the one taken by most empirical research. Notice, however, that some of these models place also testable restrictions on conditional choices, as well as explicit limitations on the allowable interhousehold comparisons of utility.[6] Nevertheless, given the arbitrariness of the cardinalization of preferences implied by any of these procedures, the testing of the empirical implications provides a necessary but not a sufficient condition for its acceptance.[7] In this context, sufficiency must depend on other criteria like *a priori*

[5]See the references quoted in Blundell and Lewbel [1990] and Hagenaars [1986]

[6]See, for example, the restrictions implied in the important case in which equivalence scales are allowed to vary with prices and household composition but are independent of the utility level, i.e., the ESE (Equivalent Scale Exactness) property of Blackorby and Donaldson [1989a, 1989b], called IB (Independent of Base utility) by Lewbel [1989a, 1989b]. This last author explores also the conditions under which IB is consistent with Barten type commodity specific scales, as well as the conection between IB and exact aggregation conditions used, for example, by Jorgenson and Slesnick [1983, 1987] in the translog context, or by Ray [1982, 1983, 1986] and Rossi [1988] in the Almost Ideal Demand System. Notice, however, that if equivalence scales are independent of prices -like in so many contributions to this volume which estimate Engel scales- nothing at all can be learned about the true equivalence scale from observed conditional demands.

[7]For some recent examples of the testing of the IB property, see Blundell, Pashardes, and Weber [1989]

reasonableness of the model, empirical convenience in applications, or *ex post* plausibility of the results obtained.

2.5 Whose welfare?

All of the above did not take into account that although the majority of households consist of more than one person, microeconomic data at the greatest level of disaggregation refers only to the total household consumption of each commodity without direct information on the allocation of these totals among household members.

To rationalize such observable choices, it suffices to assume the existence of household preferences without questioning its origin. But whose preferences are these in multiperson arrangements? This is important in normative analysis because, ultimately, we are interested in individual rather than household welfare.

A simple way out consists of assuming, like Blackorby and Donaldson [1989a, 1989b], that each household member enjoys the same level of well-being, on the grounds that the household social welfare function maximizes the utility of the worse-off individual. Then, of course, there is no difficulty in allowing every individual in the population, including children, to count in social evaluations. However, the cost of this procedure, like these authors themselves admit, is that some ethically significant intrahousehold inequality is missed.

In other interpretations, the household utility function represents parental welfare.[8] If by this we mean the utility parents derive from the commodities they themselves consume, then Gronau [1988, 1989] has argued very forcefully that a prerequisite for any comparison of consumption patterns between families of different profiles is the assumption that parents' welfare is independent of the existence of children and the composition of their consumption. Otherwise, one could not tell whether a decline in parental consumption of a commodity is caused by a diversion of resources from parents to children or by the fact that parents "lose the taste" for the good once they have children.

Gronau himself recognizes that the separability of parents' and children' consumption is not a natural assumption in the context of the family. Fortunately, whether the interactions between the two groups are important or not is an empirical question that can be put to test.[9] Setting aside the difficulties of isolating parental welfare with the available data, what we want to remark is the shift of attention toward the modeling of the effect on welfare of the intrafamily allocation of resources.

Of course, the inquiry into the nature of the household utility function need not stop here: the parental decision unit may very well admit a further breakdown into its constituent parts in the interest of both positive and normative economics[10].

in the PIGLOG context, or Phipps [1990] and Nicol [1990] in the translog one.

[8] See, for instance, Pollak and Wales [1979] and Deaton and Muellbauer [1980, 1986].

[9] See, for instance, Deaton, Ruiz-Castillo and Thomas [1989] or Gronau [1989].

[10] For an interesting commentary on different theoretical approaches to what goes on inside the household "black box", see Pollak [1985]. See also Bourguignon [1989] and the contribution of Chiappori [1990]

3 Conclusions

1. The search for an empirical basis to establish interpersonal comparisons among households has proved to be full of obstacles. Even if we restrict ourselves to situational comparisons, any attempt at the estimation of the common unconditional preference ordering from conditional commodity choices will always encounter a fundamental identification problem.

If one insists in selecting an arbitrary cardinalization, and carry on with the empirical excercise, at the very least one should make sure that the data supports the maintenance of the necessary conditions on the homogeneity of preferences and other testable restrictions often imposed by the cardinalization assumption.

2. Perhaps, the most productive efforts in this area in the near future will come from the empirical and theoretical research about what goes on inside of the household. As Pollak [1990], once more, makes clear "Abandoning the notion of household or family preferences exposes two distinct issues: the treatment of conflicting preferences of adults within the household, and the treatment of children's interests, needs, wants, and desires."

3. In the meanwhile, if the data indicates that there are different household types, this need not be the end of all welfare aggregation exercises. One could apply, for instance, the more general but less demanding approach suggested by Atkinson and Bourguignon [1987], Bourguignon [1989] and Atkinson [1987], which investigates the conditions on household utility functions, defined on income and household size, for establishing the social welfare dominance of one distribution of income over another.

Also, one could pursue the proposals contained in the contribution to this volume by Coulter, Cowell, and Jenkins [1990], trying to improve the distributional assesments by introducing robust methods which take into account a diversity of potential equivalence scales.

4. Finally, for many purposes, one may simply report the impact of, say, a certain policy on each of the household types, without insisting in solving the aggregation problem for the user of the analysis.

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to this volume. For a recent empirical study, see Lazear and Michael [1988].

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